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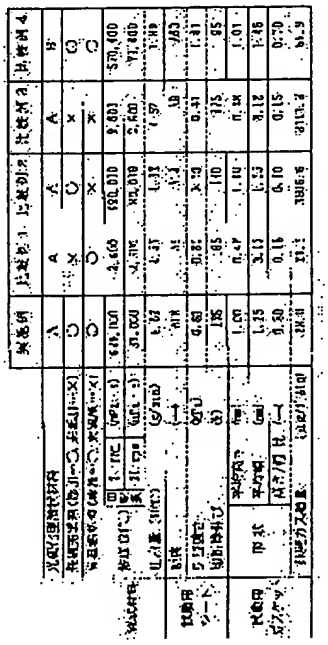
(54) LIQUID GASKET MATERIAL FOR PRECISION INSTRUMENT AND METHOD FOR PRODUCING GASKET FOR PRECISION INSTRUMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method for producing a gasket for precision instruments, realizing sufficient sealing properties and producible at a high productivity by using an X-Y-Z axes coating robot.

SOLUTION: The gasket is obtained by discharging a liquid gasket material on the surface of a substrate in stringy state with an X-Y-Z axes coating robot, curing the liquid gasket material by irradiating it with an active energy ray to obtain the gasket, wherein fluidity of the gasket material increases in dynamic state, that is, when stress is applied, but high viscosity is kept in static state, in other word, the material has extremely high thixotropy. Thereby, the liquid gasket material is effectively discharged on the surface of the substrate from the nozzle of the X-Y-Z axes coating robot at a high productivity to keep the ideal form the cross section of the discharged liquid gasket material and so as the gasket having sufficient sealing activity is produced at a high productivity.



LEGAL STATUS

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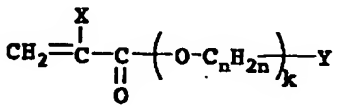
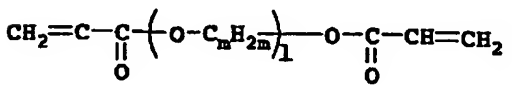
* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] It is [the 30 - 300 weight section and] [Formula 1] about the acrylate monomers indicated to be the 100 weight sections by the general formula (1) or general formula (2) of (B) following in the urethane acrylate oligomer of the molecular weight 5,000-100,000 which consists of acrylate ester which has the polyurethane oligomer which is the precision machine dexterous liquefied gasket ingredient hardened by the exposure of an activity energy line, and has (A) isocyanate radical in [two or more] 1 molecule, and a hydroxyl group (meta), and those mixture.

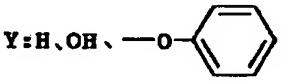


… 一般式1



… 一般式2

但し、X:H、CH_3　　n=2～12、k=1～5



l=2～14、m=2～4

(C) The precision machine dexterous gasket ingredient characterized by including 0.1 - 5 weight section for a photopolymerization initiator.
[Claim 2] The precision machine dexterous liquefied gasket ingredient indicated to claim 1 characterized by including further the inorganic bulking agent to which high thixotropy nature is made to add.
[Claim 3] The manufacture approach of the precision machine dexterous gasket characterized by what a precision machine dexterous gasket is obtained for by irradiating said breathed-out precision machine dexterous liquefied gasket ingredient, and making it harden an activity energy line after breathing out a precision machine dexterous liquefied gasket ingredient according to claim 1 or 2 in the predetermined location on the front face of a substrate from an X-Y-Z-axis spreading robot's nozzle.
[Claim 4] The manufacture approach of the precision machine dexterous gasket indicated to claim 3 characterized by carrying out high temperature processing of said precision machine dexterous gasket which was made to harden and was obtained.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About the manufacture approach of the precision machine dexterous liquefied gasket ingredient which will be hardened if activity energy lines, such as ultraviolet rays, are irradiated, and the precision machine dexterous gasket using it, in more detail, the residual strain of this invention is small by the low degree of hardness, and it relates to the manufacture approach of the precision machine dexterous gasket improved so that volatilization capacity might turn into a minute amount.
[0002]
[Description of the Prior Art] In recent years, the miniaturization of electronic equipments, such as a computer, a cellular phone, and a digital camera, progresses, and elaboration is quickly called for also for the small components used for them. Especially high-performance-izing of the hard disk drive (it expresses HDD hereafter) which is the store built in a computer also in it is remarkable.
[0003] A magnetic disk, a head and a motor, and the electronic parts relevant to them have structure which seals them completely so that may not be polluted with the foreign matter from the outside in HDD. For this reason, the macromolecule elastic body is used as a gasket generally infixed between an HDD body container and protection-against-dust covering.
[0004] On the other hand, as for the basis of the time background of high-performance-izing and a miniaturization of a personal computer, and HDD, increase of the further storage capacity is searched for. For this reason, the clearance between the magnetic disk of HDD and a head is in the inclination which becomes still narrower.
[0005] On the other hand, the volatile component generated from the components with which narrow-ization of the clearance between the magnetic disk of HDD and a head takes for progressing, and constitutes HDD pollutes a magnetic disk, causing a memory disorder is known, and this poses an important problem now. It is anxious for the gasket with which the gas which volatilizes from the gasket itself which uses a macromolecule elastic body also stopped the yield of the volatilization gas instead of an exception.
[0006] After breathing out on a substrate the liquefied ingredient which has ultraviolet-rays hardenability using an X-Y-Z-axis spreading robot in the manufacture approach of the gasket indicated by the special playback Taira No. 810594 [eight to] official report in order to solve such a trouble, by irradiating ultraviolet rays, it is chemically [simple and] stable and the gasket of a still more exact configuration is manufactured.
[0007]
[Problem(s) to be Solved by the Invention] However, there are many unsolved parts also by the manufacture approach of the gasket which the amount of volatile components mentioned above as a manufacturing method of a precision machine dexterous gasket in recent years currently asked for several ppm level.
[0008] Moreover, in order to fully demonstrate the seal engine performance of a gasket, the drag force to deformation is small, i.e., the small macromolecule elastic body of a residual strain is effective by the low degree of hardness, and it is necessary to also enlarge the squeeze at the

time of bolting, and it becomes indispensable to enlarge the cross-section height of a gasket for that purpose. It is more advantageous to use a hyperviscous ingredient as much as possible, in case the gasket of the configuration where such cross-section height is large is manufactured using an X-Y-Z-axis spreading robot. However, when a hyperviscous ingredient is used, the regurgitation capacity of a coater is reduced and the demerit that productivity falls is also produced.

[0009] Then, the purpose of this invention demonstrates sufficient seal engine performance that it can be used on the precision electronic equipment for which it is needed that the capacity which volatilizes from a gasket like HDD is a low very much, and is to offer further the manufacture approach of the precision machine dexterous gasket which can be manufactured for high productivity using an X-Y-Z-axis spreading robot.

[0010]

[Means for Solving the Problem] In the state of a liquid, this invention which solves the above-mentioned technical problem has high thixotropy nature, and after hardening by the exposure of an activity energy line, it offers the precision machine dexterous liquefied gasket ingredient in which the low degree-of-hardness nature optimal as a precision machine dexterous gasket and low residual strain nature are shown. And after applying this precision machine dexterous liquefied gasket ingredient to the predetermined location on the substrate which is protection-against-dust covering of a precision mechanical equipment using an X-Y-Z-axis spreading robot, a precision machine dexterous gasket is obtained by irradiating an activity energy line and stiffening it.

[0011] The precision machine dexterous liquefied gasket ingredient used by this invention is easily hardened by irradiating activity energy lines, such as ultraviolet rays, including the component of following (A) - (C).

(A) The urethane acrylate oligomer of the molecular weight 5,000-100,000 which consists of acrylate ester which has the polyurethane oligomer which has an isocyanate radical in [two or more] 1 molecule, and a hydroxyl group (meta), the 100 weight sections.

(B) The acrylate monomers shown by the general formula 1 or the general formula 2 and those mixture, the 30 - 300 weight section.

(C) A photopolymerization initiator, 0.1 - 5 weight section.

[0012] (A) The urethane acrylate oligomer of a component prepares urethane oligomer from which the polymerization reaction of the polyol of molecular weight 1,000-3,000, a diisocyanate compound, and the polyhydric alcohol is first carried out, and a chain end serves as an isocyanate radical, and is obtained by making the isocyanate radical which is the chain end of this urethane oligomer, and the acrylate which has active hydrogen (meta) react after that.

[0013] When the molecular weight of urethane acrylate oligomer is ideal and 5,000-100,000 are smaller than this, the endurance as a gasket is missing, and if conversely large, in order that liquid viscosity may go up, trouble occurs from a thin nozzle in the productive efficiency of applying a liquefied gasket ingredient.

[0014] As a polyol component to be used, molecular weight is used for polyester polyol, polyether polyol, polycarbonate polyol, polybutadiene polyol, hydrogenation polybutadiene polyol, etc. of 1,000-3,000 by each.

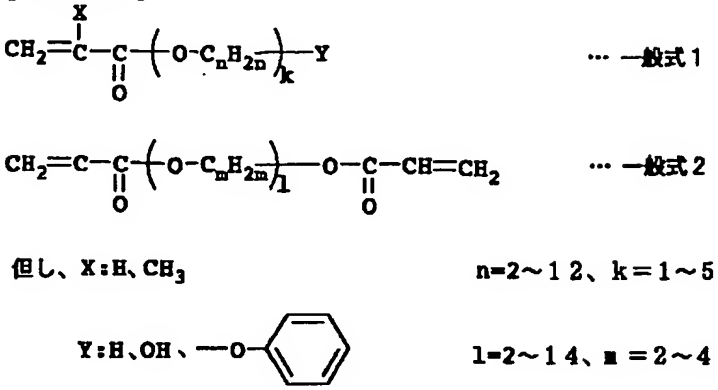
[0015] On the other hand, as a diisocyanate component, aliphatic series isocyanates, such as alicycle group isocyanates, such as aromatic series isocyanates, such as tolylene diisocyanate, diphenylmethane diisocyanate, p-phenylene diisocyanate, naphthalene diisocyanate, and tolidine di-isocyanate, isophorone diisocyanate, and hydro-diphenylmethane diisocyanate, and hexamethylene di-isocyanate, are used.

[0016] Moreover, as acrylate which has active hydrogen used in the case of acrylate-izing of urethane oligomer (meta), the caprolactone denaturation object of hydroxyethyl (meta) acrylate, hydroxypropyl (meta) acrylate, and hydroxyethyl (meta) acrylate, PENDAERISUTORUTORI acrylate, etc. are used.

[0017] (B) The acrylate monomers of a component are the compounds expressed with a following general formula 1 and a following general formula 2, and such mixture, and use them for the purpose of adjustment of physical reinforcement, such as photo-curing reactivity, and

hardness, elongation, at the same time it adds as a diluent which lowers the viscosity of urethane acrylate oligomer.

[Formula 2]



… 一般式1

… 一般式2

但し、X:H、CH_3　　n=2～12、k=1～5

Y:H、OH、—O—(benzene)　　l=2～14、m=2～4

[0018] Moreover, to use UV irradiation as a means to stiffen a liquefied gasket ingredient, it is necessary to add a photopolymerization initiator as a (C) component. The benzoin ether, benzyl dimethyl ketal, alpha-hydroxyalkyl phenon, alpha-amino alkyl phenon, etc. are mentioned, and the class of photopolymerization initiator is used as one kind or two kinds or more of mixture if needed.

[0019] The gasket manufactured by stiffening a liquefied gasket ingredient using an activity energy line performs high temperature processing, in order to make adhesive strength with a substrate increase, and in order to remove the volatile component contained in a gasket.

[0020]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of the manufacture approach of the precision machine dexterous gasket concerning this invention is explained to a detail with reference to drawing 1 thru/or drawing 6 . An X-Y-Z-axis spreading robot's outline front view used for the manufacture approach of a precision machine dexterous gasket which drawing 1 requires for this invention here, The outline side elevation of the X-Y-Z-axis spreading robot which showed drawing 2 to drawing 1 , the outline side elevation showing the condition that drawing 3 applies a liquefied gasket ingredient on a substrate front face using the X-Y-Z-axis spreading robot which showed drawing 1 and drawing 2 , The outline perspective view explaining arrangement of the liquefied gasket ingredient which breathed out drawing 4 on the substrate front face, the sectional view of a gasket which manufactured drawing 5 on the substrate front face, and drawing 6 are front drawings showing the result of an example.

[0021] In the manufacture approach of the precision machine dexterous gasket concerning this invention, the regurgitation of the precision machine dexterous liquefied gasket ingredient mentioned above is carried out to the shape of a string on the front face of a metal substrate using an X-Y-Z-axis spreading robot as shows drawing 1 and drawing 2 . This X-Y-Z-axis spreading robot 1 has the dispenser 2 guided and driven in the X-Y-Z-axis of a three dimension, i.e., the direction of the front and rear, right and left upper and lower sides. And while supplying high-pressure air to this dispenser 2 through a pipe 3, the regurgitation of the photo-curing mold liquefied gasket ingredient is carried out to the predetermined location of the front face of the metal substrate 6 laid on the level table 5 from the nozzle 4 prepared in the lower limit of a dispenser 2. Thereby, on the front face of the metal substrate 6, as shown in drawing 3 and drawing 4 , the regurgitation of the photo-curing mold liquefied gasket ingredient 7 can be continuously carried out without a break.

[0022] The X-Y-Z-axis spreading robot 1 does the regurgitation of the liquefied gasket ingredient 7 on the front face of the metal substrate 6 according to the drawing pattern of the gasket configuration programmed beforehand. It depends for the drawing speed at this time on the ease of the regurgitation of the liquefied gasket ingredient 7, i.e., the thixotropy nature of a liquefied gasket ingredient, greatly.

[0023] Activity energy lines, such as ultraviolet rays and an electron ray, are irradiated, and the

liquefied gasket ingredient 7 breathed out on the front face of the metal substrate 6 using the X-Y-Z-axis spreading robot 1 is made to harden the breathed-out liquefied gasket ingredient 7. The gasket 8 which has a cross-section configuration as shown on the front face of the metal substrate 6 at drawing 5 by this can be manufactured.

[0024] Even when the load which compresses the gasket 8 manufactured on the front face of the metal substrate 6 is low, it is the configuration which combined the rectangle and the hemicycle as it was indicated in drawing 5 as the configuration of a gasket 8 where sufficient seal engine performance can be obtained. And although the larger possible one of the value of height H of a gasket 8 and a ratio with width of face W is good, a desirable value shows an almost fixed value with the property of the liquefied gasket ingredient to be used, and is ideal. [of the value of 0.6-1.0]

[0025] However, if the viscosity of the liquefied gasket ingredient 7 which carries out the regurgitation on the front face of the metal substrate 6 is too low, since the fluidity of the liquefied gasket ingredient 7 is high, before irradiating an activity energy line and stiffening the liquefied gasket ingredient 7, a cross-section configuration begins to change, and it cannot stop in the ideal configuration which showed the cross-section configuration in drawing 5 . On the other hand, if the viscosity of the liquefied gasket ingredient 7 which carries out the regurgitation on the front face of the metal substrate 6 is too high, since the regurgitation resistance at the time of carrying out the regurgitation will increase a liquefied gasket ingredient from a nozzle 4, the manufacture effectiveness of the gasket 8 using the X-Y-Z-axis spreading robot 1 will fall sharply.

[0026] It is necessary to add thickeners, such as an inorganic bulking agent, into a photo-curing mold liquefied gasket ingredient discharge, in order to change both regurgitation configuration and productive efficiency into a better condition further, as a liquefied gasket ingredient shown above using a spreading robot like this invention, and to make high thixotropy nature add to it. The viscosity in the room temperature (25 degrees C) of the photo-curing mold liquefied gasket ingredient to which such high thixotropy nature was made to add has ideal 100,000 - 1,500,000 mPa-s at the time of 10,000 - 150,000 mPa-s and per minute 2 rotation (2rpm) at the time of per minute 20 rotation (20rpm), when it measures using a rotational viscometer.

[0027] If such thixotropy nature uses the very high liquefied gasket ingredient 7, when the liquefied gasket ingredient 7 will be breathed out from a nozzle 4, by applying a pressure (stress), a fluidity becomes high and can carry out the regurgitation of the liquefied gasket ingredient on the front face of the metal substrate 6 efficiently using the X-Y-Z-axis spreading robot 1. However, after being breathed out on the front face of the metal substrate 6, it is wide opened from the pressure (stress) by which the load was carried out, and the fluidity of the liquefied gasket ingredient 7 can fall and can hold the ideal cross-section configuration which rose highly as a gasket.

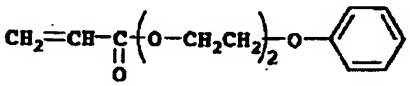
[0028] The liquefied gasket ingredient 7 applied on the metal substrate 6 by the X-Y-Z-axis spreading robot 1 is immediately stiffened using the optical irradiation equipment which generates ultraviolet rays and an electron ray. If perfect hardening is possible, this hardening reaction will not have especially a problem under an air ambient atmosphere, but if the hardenability on the front face of a gaseous phase (tuck nature) and out gas nature are taken into consideration, the exposure by the bottom of nitrogen-gas-atmosphere mind that oxygen does not exist, or the vacua is ideal.

[0029] The gasket 8 processed on the front face of the metal substrate 6 needs to perform high temperature processing, in order to make adhesive strength with the metal substrate 6 increase, and in order to remove the volatile component contained in a gasket 8. High temperature processing is carried out within a 80-180-degree C thermostat for about 3 to 24 hours, and, as for the thermostat to be used, what the air in a tub replaces at 10 times or more of a rate by the about 0.5-1.0m [/second] wind speed in 1 hour is desirable. Moreover, if it is possible to maintain the inside of a tub at the vacua of 10 or less torrs, it is still more effective in removal of the volatile component of a gasket.

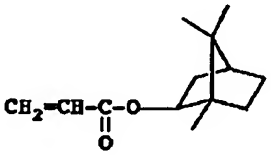
[0030]

[Example] Although an example is given to below and this invention is further explained to a

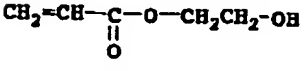
detail, this invention is not limited at all by these examples.
[0031] The polyester polyol (mean molecular weight 2000) 100.0 weight section and the 2-(2-phenoxy ethoxy) ethyl acrylate 120.5 weight section which become the 4 opening flask equipped with "preparation of photo-curing mold liquefied gasket ingredient A" stirring equipment, the condensator, and the thermometer from 3-methyl-1,5-pentanediol and an adipic acid were taught, and it heated to 80 degrees C. Then, the 4 and 4'-diphenylmethane diisocyanate 20.3 weight section was added, and the urethane-ized reaction was performed for 60 minutes at 80-100 degrees C. Subsequently, the urethane-ized reaction was carried out for the trivalent polyether polyol (molecular weight 400) which is the denaturation object of trimethylol propane for 60 minutes at 5.0 weight ****** and further 80-100 degrees C, and 2-(2-phenoxy ethoxy) ethyl acrylate solution of polyurethane oligomer was obtained. Furthermore, the 2-hydroxyethyl acrylate 5.5 weight section, the triethylenediamine 0.0256 weight section, the 1-hydroxy cyclohexyl phenyl ketone 2.6 weight section, and the hindered phenolic antioxidant (IRGANOX1010; made in Tiba Speciality Chemicals) 2.6 weight section were added to the acrylate solution of this polyurethane oligomer, the end acrylate-ized reaction of polyurethane oligomer was carried out for 90 minutes at 80-100 degrees C, and the photo-curing mold liquefied gasket ingredient A was obtained.
[0032] The polyester polyol (mean molecular weight 2000) 100.0 weight section and the isobornyl acrylate 120.5 weight section which become the 4 opening flask equipped with "preparation of photo-curing mold liquefied gasket ingredient B" stirring equipment, the condensator, and the thermometer from 3-methyl-1,5-pentanediol and an adipic acid were taught, and it heated to 80 degrees C. Then, the 4 and 4'-diphenylmethane diisocyanate 20.3 weight section was added, and the urethane-ized reaction was performed for 60 minutes at 80-100 degrees C. Subsequently, the urethane-ized reaction was carried out for the trivalent polyether polyol (molecular weight 400) which is the denaturation object of trimethylol propane for 60 minutes at 5.0 weight ****** and further 80-100 degrees C, and the isobornyl acrylate solution of polyurethane oligomer was obtained. Furthermore, the 2-hydroxyethyl acrylate 5.5 weight section, the triethylenediamine 0.0256 weight section, the 1-hydroxy cyclohexyl phenyl ketone 2.6 weight section, and the hindered phenolic antioxidant (IRGANOX1010; made in Tiba Speciality Chemicals) 2.6 weight section were added to the acrylate solution of this polyurethane oligomer, the end acrylate-ized reaction of polyurethane oligomer was carried out for 90 minutes at 80-100 degrees C, and the photo-curing mold liquefied gasket ingredient B was obtained.
[0033] In addition, the chemical formula of 2-(2-phenoxy ethoxy) ethyl acrylate, 2-hydroxyethyl acrylate, and isobornyl acrylate is shown below.
[Formula 3]



2-(2-フェノキシエトキシ) エチルアクリレート



イソボルニルアクリレート



2-ヒドロキシエチルアクリレート

[0034]
[Example] "Kneading which is an inorganic bulking agent" After adding and carrying out **** mixing so that it may become the photo-curing mold liquefied gasket ingredient A which prepared as mentioned above and was obtained with 5wt(s)% about a hydrophilic silica (primary particle diameter: about 12nm), it kneaded 3 times by 3 roll mills, and the silica was distributed.
[0035] The photo-curing mold liquefied gasket ingredient made to thicken as mentioned above using the "shaping of gasket for trial" X-Y-Z-axis spreading robot 1 was applied by the drawing pattern shown in drawing 4 on HDD protection-against-dust covering (70x100x0.4mm) made from electroless-nickel-plating aluminum of finishing [cleaning]. Then, ultraviolet rays were

irradiated with the exposure of 6,000 mJ/cm2 under the air ambient atmosphere, and the liquefied gasket ingredient 7 was stiffened.
[0036] "Shaping which is a sheet for a trial" The photo-curing mold liquefied gasket ingredient made to thicken as mentioned above was slushed in the glass mold (20x100x2mm), ultraviolet rays were irradiated with the exposure of 6,000 mJ/cm2 under the air ambient atmosphere after that, and the liquefied gasket ingredient 7 was stiffened.
[0037] "Elevated-temperature heat treatment" Elevated-temperature heat treatment was carried out for the gasket for a trial and sheet which were fabricated as mentioned above within the 160-degree C thermostat for 7 hours.
[0038] "Example 1 of a comparison" An inorganic bulking agent was not added into the photo-curing mold liquefied gasket ingredient A which prepared as mentioned above and was obtained, but "the gasket for a trial and the sheet for a trial" were fabricated with viscosity as it is, and elevated-temperature heat treatment was performed.
[0039] Elevated-temperature heat treatment was not performed to "the gasket for a trial and the sheet for a trial" in the example which carried out the "example 2 of comparison" ****.
[0040] Elevated-temperature heat treatment was not performed to the gasket for a trial and the sheet for a trial in the "example 1 of a comparison" which carried out the "example 3 of comparison" ****.
[0041] "the example 4 of a comparison" -- the photo-curing mold liquefied gasket ingredient B which prepared as mentioned above and was obtained -- "an example" -- similarly, after adding and kneading a hydrophilic silica, the gasket for a trial and the sheet for a trial were fabricated, and elevated-temperature heat treatment was performed.
[0042] The viscosity test fluid-like gasket ingredient was taken in the suitable container, and the viscosity in 25 degrees C was measured with B mold rotational viscometer.
[0043] The liquefied gasket ingredient was taken to the syringe (the bore of 15mm, ten cc of inner capacity) which attached the nozzle with an amount trial bore [of discharge flow] of 1.43mm, and the discharge quantity of the liquefied gasket ingredient (60 degrees C) when applying the pneumatic pressure of 0.03MPa was measured.
[0044] In the sheet for a hardness test trial, the rubber degree of hardness was measured according to JISK6253.
[0045] In the sheet for a tension test trial, elongation was measured according to JISK6251 at the time of tensile strength and cutting.
[0046] In the gasket for a volatilization gasometry test trial, the quantum of the gas which volatilizes by the following approaches at the time of heating was performed. The gasket for a trial was heated at 110 degrees C under the helium purge for 18 hours, and uptake of the gas which occurred then was carried out to the adsorbent. The collection of recapture of the generating gas which carried out uptake was carried out within the purge & trap equipment which used the dynamic head space method, it was introduced into GC-MS equipment after that, and carried out quantitative analysis. The quantum was carried out by n tetradecane conversion.
[0047] The result of having evaluated an example and the examples 1-4 of a comparison by the above-mentioned trial is shown in drawing 6 .
[0048] By adding an inorganic bulking agent and raising the thixotropy nature of a photo-curing mold liquefied gasket ingredient, regurgitation capacity of regurgitation equipment was not able to be hurt and the gasket of a configuration ideal for the high seal engine performance of "height / width-of-face ratio" was able to be obtained. Moreover, the gasket was able to reduce volatilization capacity sharply by performing elevated-temperature heat treatment. On the other hand, the general formula 1 and the general formula 2 were unsuitable for the rubber degree of hardness after ultraviolet curing becoming high, and fully filling the seal engine performance as a precision machine dexterous gasket with the "example 4 of a comparison" which used the reactant diluent of different structure.
[0049]
[Effect of the Invention] The cross-section configuration of the breathed-out liquefied gasket ingredient can be held in a cross-section configuration ideal for the seal engine performance of a gasket for efficient high productivity by applying the photo-curing mold liquefied gasket

ingredient in which the high thixotropy nature concerning this invention is shown in the shape of a string on a protection-against-dust covering front face using an X-Y-Z-axis spreading robot so that clearly from the above explanation. Moreover, the gasket which was made to harden the liquefied gasket ingredient applied by irradiating activity energy lines, such as ultraviolet rays, and was manufactured performs elevated-temperature heat treatment in order to remove the volatile component contained in rubber, and in order to make an adhesive property with a substrate increase. Thereby, an adhesive property with a metal substrate is high, and priming and adhesives are unnecessary, and the manufacture of the precision machine dexterous gasket of very few low out gas nature of the volatilizing capacity is attained.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] About the manufacture approach of the precision machine dexterous liquefied gasket ingredient which will be hardened if activity energy lines, such as ultraviolet rays, are irradiated, and the precision machine dexterous gasket using it, in more detail, the residual strain of this invention is small by the low degree of hardness, and it relates to the manufacture approach of the precision machine dexterous gasket improved so that volatilization capacity might turn into a minute amount.

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PRIOR ART

[Description of the Prior Art] In recent years, the miniaturization of electronic equipments, such as a computer, a cellular phone, and a digital camera, progresses, and elaboration is quickly called for also for the small components used for them. Especially high-performance-izing of the hard disk drive (it expresses HDD hereafter) which is the store built in a computer also in it is remarkable.
[0003] A magnetic disk, a head and a motor, and the electronic parts relevant to them have structure which seals them completely so that may not be polluted with the foreign matter from the outside in HDD. For this reason, the macromolecule elastic body is used as a gasket generally infixed between an HDD body container and protection-against-dust covering.
[0004] On the other hand, as for the basis of the time background of high-performance-izing and a miniaturization of a personal computer, and HDD, increase of the further storage capacity is searched for. For this reason, the clearance between the magnetic disk of HDD and a head is in the inclination which becomes still narrower.
[0005] On the other hand, the volatile component generated from the components with which narrow-ization of the clearance between the magnetic disk of HDD and a head takes for progressing, and constitutes HDD pollutes a magnetic disk, causing a memory disorder is known, and this poses an important problem now. It is anxious for the gasket with which the gas which volatilizes from the gasket itself which uses a macromolecule elastic body also stopped the yield of the volatilization gas instead of an exception.
[0006] After breathing out on a substrate the liquefied ingredient which has ultraviolet-rays hardenability using an X-Y-Z-axis spreading robot in the manufacture approach of the gasket indicated by the special playback Taira No. 810594 [eight to] official report in order to solve such a trouble, by irradiating ultraviolet rays, it is chemically [simple and] stable and the gasket of a still more exact configuration is manufactured.

[Translation done.]

* NOTICES *

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EFFECT OF THE INVENTION

[Effect of the Invention] The cross-section configuration of the breathed-out liquefied gasket ingredient can be held in a cross-section configuration ideal for the seal engine performance of a gasket for efficient high productivity by applying the photo-curing mold liquefied gasket ingredient in which the high thixotropy nature concerning this invention is shown in the shape of a string on a protection-against-dust covering front face using an X-Y-Z-axis spreading robot so that clearly from the above explanation. Moreover, the gasket which was made to harden the liquefied gasket ingredient applied by irradiating activity energy lines, such as ultraviolet rays, and was manufactured performs elevated-temperature heat treatment in order to remove the volatile component contained in rubber, and in order to make an adhesive property with a substrate increase. Thereby, an adhesive property with a metal substrate is high, and priming and adhesives are unnecessary, and the manufacture of the precision machine dexterous gasket of very few low out gas nature of the volatilizing capacity is attained.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, there are many unsolved parts also by the manufacture approach of the gasket which the amount of volatile components mentioned above as a manufacturing method of a precision machine dexterous gasket in recent years currently asked for several ppm level.
[0008] Moreover, in order to fully demonstrate the seal engine performance of a gasket, the drag force to deformation is small, i.e., the small macromolecule elastic body of a residual strain is effective by the low degree of hardness, and it is necessary to also enlarge the squeeze at the time of bolting, and it becomes indispensable to enlarge the cross-section height of a gasket for that purpose. It is more advantageous to use a hyperviscous ingredient as much as possible, in case the gasket of the configuration where such cross-section height is large is manufactured using an X-Y-Z-axis spreading robot. However, when a hyperviscous ingredient is used, the regurgitation capacity of a coater is reduced and the demerit that productivity falls is also produced.
[0009] Then, the purpose of this invention demonstrates sufficient seal engine performance that it can be used on the precision electronic equipment for which it is needed that the capacity which volatilizes from a gasket like HDD is a low very much, and is to offer further the manufacture approach of the precision machine dexterous gasket which can be manufactured for high productivity using an X-Y-Z-axis spreading robot.

[Translation done.]

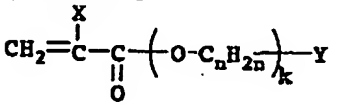
* NOTICES *

MEANS

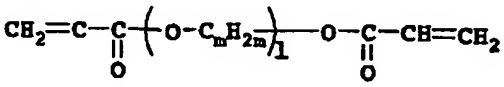
[Means for Solving the Problem] In the state of a liquid, this invention which solves the above-mentioned technical problem has high thixotropy nature, and after hardening by the exposure of an activity energy line, it offers the precision machine dexterous liquefied gasket ingredient in which the low degree-of-hardness nature optimal as a precision machine dexterous gasket and low residual strain nature are shown. And after applying this precision machine dexterous liquefied gasket ingredient to the predetermined location on the substrate which is protection-against-dust covering of a precision mechanical equipment using an X-Y-Z-axis spreading robot, a precision machine dexterous gasket is obtained by irradiating an activity energy line and stiffening it.
[0011] The precision machine dexterous liquefied gasket ingredient used by this invention is easily hardened by irradiating activity energy lines, such as ultraviolet rays, including the component of following (A) - (C).
(A) The urethane acrylate oligomer of the molecular weight 5,000-100,000 which consists of acrylate ester which has the polyurethane oligomer which has an isocyanate radical in [two or more] 1 molecule, and a hydroxyl group (meta), the 100 weight sections.
(B) The acrylate monomers shown by the general formula 1 or the general formula 2 and those mixture, the 30 - 300 weight section.
(C) A photopolymerization initiator, 0.1 - 5 weight section.
[0012] (A) The urethane acrylate oligomer of a component prepares urethane oligomer from which the polymerization reaction of the polyol of molecular weight 1,000-3,000, a diisocyanate compound, and the polyhydric alcohol is first carried out, and a chain end serves as an isocyanate radical, and is obtained by making the isocyanate radical which is the chain end of this urethane oligomer, and the acrylate which has active hydrogen (meta) react after that.
[0013] When the molecular weight of urethane acrylate oligomer is ideal and 5,000-100,000 are smaller than this, the endurance as a gasket is missing, and if conversely large, in order that liquid viscosity may go up, trouble occurs from a thin nozzle in the productive efficiency of applying a liquefied gasket ingredient.
[0014] As a polyol component to be used, molecular weight is used for polyester polyol, polyether polyol, polycarbonate polyol, polybutadiene polyol, hydrogenation polybutadiene polyol, etc. of 1,000-3,000 by each.
[0015] On the other hand, as a diisocyanate component, aliphatic series isocyanates, such as alicycle group isocyanates, such as aromatic series isocyanates, such as tolylene diisocyanate, diphenylmethane diisocyanate, p-phenylene diisocyanate, naphthalene diisocyanate, and tolidine di-isocyanate, isophorone diisocyanate, and hydro-diphenylmethane diisocyanate, and hexamethylene di-isocyanate, are used.
[0016] Moreover, as acrylate which has active hydrogen used in the case of acrylate-izing of urethane oligomer (meta), the caprolactone denaturation object of hydroxyethyl (meta) acrylate, hydroxypropyl (meta) acrylate, and hydroxyethyl (meta) acrylate, PENDAERISUTORUTORI acrylate, etc. are used.
[0017] (B) The acrylate monomers of a component are the compounds expressed with a following general formula 1 and a following general formula 2, and such mixture, and use them for

the purpose of adjustment of physical reinforcement, such as photo-curing reactivity, and hardness, elongation, at the same time it adds as a diluent which lowers the viscosity of urethane acrylate oligomer.

[Formula 2]

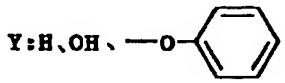


… 一般式1



… 一般式2

但し、X:H、CH_3　　n=2～12、k=1～5



l=2～14、m=2～4

[0018] Moreover, to use UV irradiation as a means to stiffen a liquefied gasket ingredient, it is necessary to add a photopolymerization initiator as a (C) component. The benzoin ether, benzyl dimethyl ketal, alpha-hydroxyalkyl phenon, alpha-amino alkyl phenon, etc. are mentioned, and the class of photopolymerization initiator is used as one kind or two kinds or more of mixture if needed.

[0019] The gasket manufactured by stiffening a liquefied gasket ingredient using an activity energy line performs high temperature processing, in order to make adhesive strength with a substrate increase, and in order to remove the volatile component contained in a gasket.

[0020]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of the manufacture approach of the precision machine dexterous gasket concerning this invention is explained to a detail with reference to drawing 1 thru/or drawing 6 . An X-Y-Z-axis spreading robot's outline front view used for the manufacture approach of a precision machine dexterous gasket which drawing 1 requires for this invention here, The outline side elevation of the X-Y-Z-axis spreading robot which showed drawing 2 to drawing 1 , the outline side elevation showing the condition that drawing 3 applies a liquefied gasket ingredient on a substrate front face using the X-Y-Z-axis spreading robot which showed drawing 1 and drawing 2 , The outline perspective view explaining arrangement of the liquefied gasket ingredient which breathed out drawing 4 on the substrate front face, the sectional view of a gasket which manufactured drawing 5 on the substrate front face, and drawing 6 are front drawings showing the result of an example.

[0021] In the manufacture approach of the precision machine dexterous gasket concerning this invention, the regurgitation of the precision machine dexterous liquefied gasket ingredient mentioned above is carried out to the shape of a string on the front face of a metal substrate using an X-Y-Z-axis spreading robot as shows drawing 1 and drawing 2 . This X-Y-Z-axis spreading robot 1 has the dispenser 2 guided and driven in the X-Y-Z-axis of a three dimension, i.e., the direction of the front and rear, right and left upper and lower sides. And while supplying high-pressure air to this dispenser 2 through a pipe 3, the regurgitation of the photo-curing mold liquefied gasket ingredient is carried out to the predetermined location of the front face of the metal substrate 6 laid on the level table 5 from the nozzle 4 prepared in the lower limit of a dispenser 2. Thereby, on the front face of the metal substrate 6, as shown in drawing 3 and drawing 4 , the regurgitation of the photo-curing mold liquefied gasket ingredient 7 can be continuously carried out without a break.

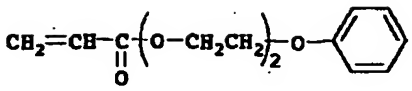
[0022] The X-Y-Z-axis spreading robot 1 does the regurgitation of the liquefied gasket ingredient 7 on the front face of the metal substrate 6 according to the drawing pattern of the gasket configuration programmed beforehand. It depends for the drawing speed at this time on the ease of the regurgitation of the liquefied gasket ingredient 7, i.e., the thixotropy nature of a liquefied gasket ingredient, greatly.

[0023] Activity energy lines, such as ultraviolet rays and an electron ray, are irradiated, and the liquefied gasket ingredient 7 breathed out on the front face of the metal substrate 6 using the X-Y-Z-axis spreading robot 1 is made to harden the breathed-out liquefied gasket ingredient 7. The gasket 8 which has a cross-section configuration as shown on the front face of the metal substrate 6 at drawing 5 by this can be manufactured.
[0024] Even when the load which compresses the gasket 8 manufactured on the front face of the metal substrate 6 is low, it is the configuration which combined the rectangle and the hemicycle as it was indicated in drawing 5 as the configuration of a gasket 8 where sufficient seal engine performance can be obtained. And although the larger possible one of the value of height H of a gasket 8 and a ratio with width of face W is good, a desirable value shows an almost fixed value with the property of the liquefied gasket ingredient to be used, and is ideal. [of the value of 0.6-1.0]
[0025] However, if the viscosity of the liquefied gasket ingredient 7 which carries out the regurgitation on the front face of the metal substrate 6 is too low, since the fluidity of the liquefied gasket ingredient 7 is high, before irradiating an activity energy line and stiffening the liquefied gasket ingredient 7, a cross-section configuration begins to change, and it cannot stop in the ideal configuration which showed the cross-section configuration in drawing 5 . On the other hand, if the viscosity of the liquefied gasket ingredient 7 which carries out the regurgitation on the front face of the metal substrate 6 is too high, since the regurgitation resistance at the time of carrying out the regurgitation will increase a liquefied gasket ingredient from a nozzle 4, the manufacture effectiveness of the gasket 8 using the X-Y-Z-axis spreading robot 1 will fall sharply.
[0026] It is necessary to add thickeners, such as an inorganic bulking agent, into a photo-curing mold liquefied gasket ingredient discharge, in order to change both regurgitation configuration and productive efficiency into a better condition further, as a liquefied gasket ingredient shown above using a spreading robot like this invention, and to make high thixotropy nature add to it. The viscosity in the room temperature (25 degrees C) of the photo-curing mold liquefied gasket ingredient to which such high thixotropy nature was made to add has ideal 100,000 - 1,500,000 mPa-s at the time of 10,000 - 150,000 mPa-s and per minute 2 rotation (2rpm) at the time of per minute 20 rotation (20rpm), when it measures using a rotational viscometer.
[0027] If such thixotropy nature uses the very high liquefied gasket ingredient 7, when the liquefied gasket ingredient 7 will be breathed out from a nozzle 4, by applying a pressure (stress), a fluidity becomes high and can carry out the regurgitation of the liquefied gasket ingredient on the front face of the metal substrate 6 efficiently using the X-Y-Z-axis spreading robot 1. However, after being breathed out on the front face of the metal substrate 6, it is wide opened from the pressure (stress) by which the load was carried out, and the fluidity of the liquefied gasket ingredient 7 can fall and can hold the ideal cross-section configuration which rose highly as a gasket.
[0028] The liquefied gasket ingredient 7 applied on the metal substrate 6 by the X-Y-Z-axis spreading robot 1 is immediately stiffened using the optical irradiation equipment which generates ultraviolet rays and an electron ray. If perfect hardening is possible, this hardening reaction will not have especially a problem under an air ambient atmosphere, but if the hardenability on the front face of a gaseous phase (tuck nature) and out gas nature are taken into consideration, the exposure by the bottom of nitrogen-gas-atmosphere mind that oxygen does not exist, or the vacua is ideal.
[0029] The gasket 8 processed on the front face of the metal substrate 6 needs to perform high temperature processing, in order to make adhesive strength with the metal substrate 6 increase, and in order to remove the volatile component contained in a gasket 8. High temperature processing is carried out within a 80-180-degree C thermostat for about 3 to 24 hours, and, as for the thermostat to be used, what the air in a tub replaces at 10 times or more of a rate by the about 0.5-1.0m [/second] wind speed in 1 hour is desirable. Moreover, if it is possible to maintain the inside of a tub at the vacua of 10 or less torrs, it is still more effective in removal of the volatile component of a gasket.

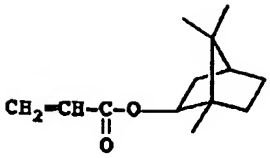
[Translation done.]

EXAMPLE

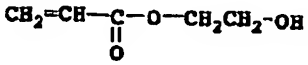
[Example] Although an example is given to below and this invention is further explained to a detail, this invention is not limited at all by these examples.
[0031] The polyester polyol (mean molecular weight 2000) 100.0 weight section and the 2-(2-phenoxy ethoxy) ethyl acrylate 120.5 weight section which become the 4 opening flask equipped with "preparation of photo-curing mold liquefied gasket ingredient A" stirring equipment, the condensator, and the thermometer from 3-methyl-1,5-pentanediol and an adipic acid were taught, and it heated to 80 degrees C. Then, the 4 and 4'-diphenylmethane diisocyanate 20.3 weight section was added, and the urethane-ized reaction was performed for 60 minutes at 80-100 degrees C. Subsequently, the urethane-ized reaction was carried out for the trivalent polyether polyol (molecular weight 400) which is the denaturation object of trimethylol propane for 60 minutes at 5.0 weight ****** and further 80-100 degrees C, and 2-(2-phenoxy ethoxy) ethyl acrylate solution of polyurethane oligomer was obtained. Furthermore, the 2-hydroxyethyl acrylate 5.5 weight section, the triethylenediamine 0.0256 weight section, the 1-hydroxy cyclohexyl phenyl ketone 2.6 weight section, and the hindered phenolic antioxidant (IRGANOX1010; made in Tiba Speciality Chemicals) 2.6 weight section were added to the acrylate solution of this polyurethane oligomer, the end acrylate-ized reaction of polyurethane oligomer was carried out for 90 minutes at 80-100 degrees C, and the photo-curing mold liquefied gasket ingredient A was obtained.
[0032] The polyester polyol (mean molecular weight 2000) 100.0 weight section and the isobornyl acrylate 120.5 weight section which become the 4 opening flask equipped with "preparation of photo-curing mold liquefied gasket ingredient B" stirring equipment, the condensator, and the thermometer from 3-methyl-1,5-pentanediol and an adipic acid were taught, and it heated to 80 degrees C. Then, the 4 and 4'-diphenylmethane diisocyanate 20.3 weight section was added, and the urethane-ized reaction was performed for 60 minutes at 80-100 degrees C. Subsequently, the urethane-ized reaction was carried out for the trivalent polyether polyol (molecular weight 400) which is the denaturation object of trimethylol propane for 60 minutes at 5.0 weight ****** and further 80-100 degrees C, and the isobornyl acrylate solution of polyurethane oligomer was obtained. Furthermore, the 2-hydroxyethyl acrylate 5.5 weight section, the triethylenediamine 0.0256 weight section, the 1-hydroxy cyclohexyl phenyl ketone 2.6 weight section, and the hindered phenolic antioxidant (IRGANOX1010; made in Tiba Speciality Chemicals) 2.6 weight section were added to the acrylate solution of this polyurethane oligomer, the end acrylate-ized reaction of polyurethane oligomer was carried out for 90 minutes at 80-100 degrees C, and the photo-curing mold liquefied gasket ingredient B was obtained.
[0033] In addition, the chemical formula of 2-(2-phenoxy ethoxy) ethyl acrylate, 2-hydroxyethyl acrylate, and isobornyl acrylate is shown below.
[Formula 3]



2-(2-フェノキシエトキシ) エチルアクリレート



イソボルニルアクリレート



2-ヒドロキシエチルアクリレート

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] An X-Y-Z-axis spreading robot's outline front view used in the manufacture approach of the precision machine dexterous gasket concerning this invention.
[Drawing 2] An X-Y-Z-axis spreading robot's outline side elevation shown in drawing 1 .
[Drawing 3] The outline side elevation showing the condition of carrying out the regurgitation of the liquefied gasket ingredient on a substrate front face using the X-Y-Z-axis spreading robot which showed drawing 1 and drawing 2 .
[Drawing 4] The outline perspective view explaining arrangement of the liquefied gasket ingredient breathed out on the substrate front face.
[Drawing 5] The sectional view of the gasket manufactured on the substrate front face.
[Drawing 6] Front drawing showing the result of an example.
[Description of Notations]
1 X-Y-Z-axis Spreading Robot
2 Dispenser
3 Pressure Air Supply Tubing
4 Nozzle
5 Level Table
6 Metal Substrate
7 Liquefied Gasket Ingredient
8 Gasket

[Translation done.]

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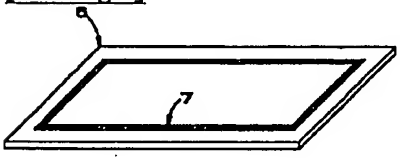
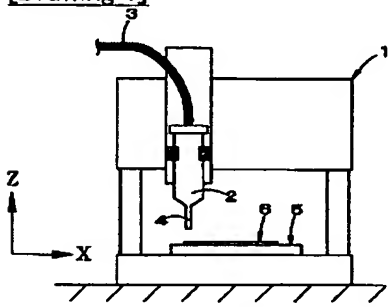
DRAWINGS

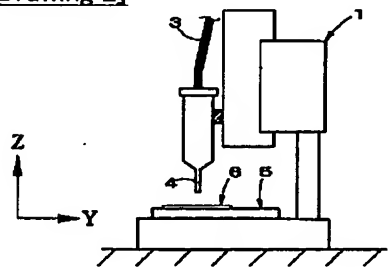
[Drawing 4]



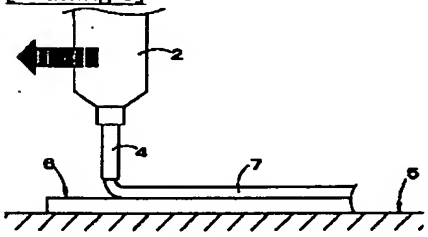
[Drawing 1]



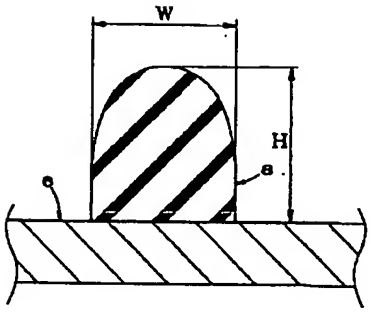
[Drawing 2]



[Drawing 3]



[Drawing 5]



[Drawing 6]

				実施例	比較例1	比較例2	比較例3	比較例4
	光硬化型液状材料			A	A	A	A	B
	無機充填剤(添加…○, 未添加…×)			○	×	○	×	○
	高温熱処理(実施…○, 未実施…×)			○	○	×	×	○
液状材料	粘度(25℃)	回転数	2 rpm (mPa・s)	620,000	2,600	620,000	2,600	570,000
			20 rpm (mPa・s)	89,000	2,500	89,000	2,500	78,000
	吐出量 (80℃)		(g/min)	1.62	4.57	1.62	4.57	1.89
試験用シート	硬度		(—)	A18	A9	A18	A8	A63
	引張強さ		(MPa)	0.81	0.39	0.79	0.41	1.81
	切断時伸び		(%)	135	165	140	175	95
試験用ガスケット	形状	平均高さ	(mm)	1.00	0.48	1.00	0.48	1.01
		平均幅	(mm)	1.25	3.12	1.25	3.12	1.45
		高さ/幅 比	(—)	0.80	0.15	0.80	0.15	0.70
	揮発ガス総量		(μg/ｺﾞAlg)	28.0	20.9	3608.6	3711.8	58.9

[Translation done.]